

THE CLAIMS

What is claimed is:

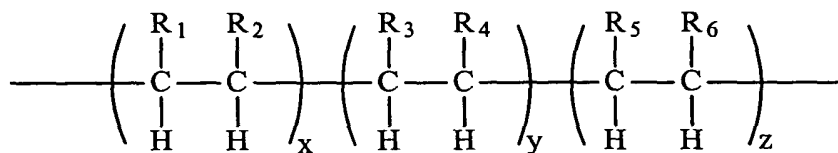
1. A golf ball comprising:
5 a core;
an inner cover having at least one layer comprising a material having a first Shore D hardness formed over the core and comprising a thermoplastic material; and
an outer cover layer comprising a material having a second Shore D hardness disposed about the inner cover, formed from a polymer blend comprising at least one
10 grafted metallocene-catalyzed polymer and an ionomer component,
wherein the first Shore D hardness is greater than the second Shore D hardness.
2. The golf ball of claim 1, wherein the polymer blend comprises about
15 30 percent by weight or greater of the at least one grafted metallocene-catalyzed polymer.
3. The golf ball of claim 2, wherein the polymer blend comprises about 35 percent by weight or greater of the at least one grafted metallocene-catalyzed polymer.
- 20 4. The golf ball of claim 1, wherein the at least one grafted metallocene-catalyzed polymer has been functionalized by grafting an ethylenically-unsaturated monomer onto the at least one metallocene-catalyzed polymer using a post-polymerization reaction.
- 25 5. The golf ball of claim 4, wherein the ethylenically-unsaturated monomer is an olefinic monomer having a functional group selected from the group consisting of sulfonic acid, sulfonic acid derivatives, chlorosulfonic acid, vinyl ethers, vinyl esters, primary amines, secondary amines, tertiary amines, mono-carboxylic acids, dicarboxylic acids, partially or fully ester derivatized mono-carboxylic acids, partially or
30 fully ester derivatized dicarboxylic acids, anhydrides of dicarboxylic acids, cyclic imides of dicarboxylic acids, ionomeric derivatives thereof, and combinations thereof.

6. The golf ball of claim 5, wherein the ethylenically-unsaturated monomer comprises maleic anhydride.

5 7. The golf ball of claim 1, wherein the at least one grafted metallocene-catalyzed polymer is formed by grafting an ethylenically-unsaturated monomer onto a metallocene-catalyzed polymer selected from the group consisting of polyethylene and copolymers of ethylene with propylene, butene, pentene, hexene, heptene, octene, and norbornene.

10 8. The golf ball of claim 7, wherein the at least one grafted metallocene-catalyzed polymer is formed by grafting an ethylenically-unsaturated monomer onto a metallocene-catalyzed polymer selected from the group consisting of polyethylene and copolymers of ethylene with butene.

15 9. The golf ball of claim 1, wherein the at least one grafted metallocene-catalyzed polymer is formed by grafting an ethylenically-unsaturated monomer onto a metallocene-catalyzed polymer of the formula:



wherein R_1 is hydrogen;

20 R_2 is hydrogen or lower alkyl selected from the group consisting of CH_3 , C_2H_5 , C_3H_7 , C_4H_9 , and C_5H_{11} ;

R_3 is hydrogen or lower alkyl selected from the group consisting of CH_3 , C_2H_5 , C_3H_7 , C_4H_9 , and C_5H_{11} ;

25 R_4 is selected from the group consisting of H, CH_3 , C_2H_5 , C_3H_7 , C_4H_9 , C_5H_{11} , C_6H_{13} , C_7H_{15} , C_8H_{17} , C_9H_{19} , $\text{C}_{10}\text{H}_{21}$, and phenyl, in which from 1 to 5 H and R_4 can be replaced by substituents selected from the group consisting of COOH , SO_3H , NH_2 , F, Cl, Br, I, OH, SH, silicone, lower alkyl esters and lower alkyl ethers, with the proviso that R_3 and R_4 can be combined to form a bicyclic ring;

R₅ is hydrogen, lower alkyl including C₁-C₅, carbocyclic, aromatic or heterocyclic;

R₆ is hydrogen, lower alkyl including C₁-C₅, carbocyclic, aromatic or heterocyclic; and

5 wherein x ranges from 99 to 50 weight per cent of the polymer, y ranges from 1 to 50 weight per cent of the polymer and z ranges from 0 to 49 weight per cent of the polymer.

10 10. The golf ball of claim 1, wherein the thermoplastic material comprises at least one ionomer resin.

11. The golf ball of claim 10, wherein the at least one ionomer resin is neutralized with a metal cation comprising at least one of Na, Li, Ca, K, or Mg.

15 12. The golf ball of claim 1, wherein the ionomer component comprises at least two ionomer resins, each neutralized with a different metal cation selected from the group consisting of Zn, Na, Li, Ca, K, and Mg.

20 13. The golf ball of claim 1, wherein the inner cover layer has a thickness of about 0.039 inches or less.

14. The golf ball of claim 13, wherein the inner cover layer has a thickness from about 0.02 inches to 0.038 inches.

25 15. The golf ball of claim 1, wherein the first Shore D hardness is about 60 or greater and the second Shore D hardness is about 60 or less.

16. The golf ball of claim 15, wherein the first Shore D hardness is from about 65 to 80, and the second Shore D hardness is from about 45 to 60.

30 17. The golf ball of claim 15, wherein the first Shore D hardness is from about 65 to 80, and the second Shore D hardness is from about 51 to 60.

18. The golf ball of claim 1, wherein the outer cover layer material has a flexural modulus of about 10,000 psi or greater.

5 19. The golf ball of claim 1, wherein the outer cover layer has a thickness from about 0.01 inches to 0.1 inches.

20. The golf ball of claim 19, wherein the outer cover layer has a thickness from about 0.02 inches to 0.06 inches.

10 21. The golf ball of claim 1, wherein the golf ball has at least one of a compression of about 80 or less and a coefficient of restitution of about 0.8 or greater, or both.

22. The golf ball of claim 1, wherein the core comprises polybutadiene
15 having an uncross-linked Mooney viscosity of about 40 or greater.

23. The golf ball of claim 1, wherein the core is substantially free of organic sulfides.

20 24. The golf ball of claim 1, wherein the core further comprises at least one inorganic sulfide.

25 25. The golf ball of claim 1, wherein the core has an outer diameter of about 1.51 inches or greater.

26. The golf ball of claim 1, wherein the core has a compression of about 90 or less.

30 27. The golf ball of claim 1, wherein the core has a compression from about 65 to 90.

28. A golf ball comprising:

a core comprising polybutadiene and substantially free of organic sulfide;
an inner cover having at least one layer comprising a material having a first
Shore D hardness formed over the core and comprising at least two thermoplastic materials,
each neutralized with a different metal cation, and wherein the inner cover layer is
5 substantially free of metallocene-catalyzed polymer; and
an outer cover having at least one layer comprising a polymer blend having a
second Shore D hardness less than the first Shore D hardness, disposed about the inner
cover, wherein the polymer blend comprises at least one grafted metallocene-catalyzed
polymer and at least two ionomer resins, each neutralized with a different metal cation.

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29. The golf ball of claim 28, wherein the polymer blend comprises about
30 percent by weight or greater of the at least one grafted metallocene-catalyzed polymer.

30. The golf ball of claim 28, wherein the at least one grafted
15 metallocene-catalyzed polymer has been functionalized by grafting an ethylenically-
unsaturated monomer onto the at least one metallocene-catalyzed polymer using a
post-polymerization reaction.

31. The golf ball of claim 28, wherein the core is fluid-filled.

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32. The golf ball of claim 28, wherein the golf ball further comprises at
least one intermediate layer between the core and the inner cover layer.

33. The golf ball of claim 32, wherein the intermediate layer is a
25 tensioned elastomeric layer.

34. A method of making a golf ball, comprising the steps of:
providing a golf ball;
forming an inner cover having at least one layer, comprising a material
30 having a Shore D hardness of about 60 or greater, and wherein the inner cover comprises at
least one ionomer resin and is substantially free of metallocene-catalyzed polymer; and

forming an outer cover having at least one layer, comprising a polymer blend having a Shore D hardness of about 60 or less disposed about the inner cover, wherein the polymer blend comprises at least one grafted metallocene-catalyzed polymer and at least one ionomer resin.